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(54) Control bus for multi-component consumer electronics system.

(57) A consumer electronics system has plural apparatuses interconnected by a multiple channel for control and data signalization including a control channel. The control channel is a qualifier bus that in each apparatus is interfaced to a control element that in an initiator apparatus transmits a message selectively specifying a proprietary signalization interface. A follower apparatus acknowledges the message if the user signalization interfaces match. Thereupon, the system coactivates the matched interfaces in initiator and follower apparatuses. In an extended form, the apparatuses as a prerequisite try to consent about a standard protocol on a further control channel external to said multiple channel.

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BACKGROUND TO THE INVENTION

The invention relates to a consumer electronics system comprising a plurality of apparatuses that are interconnected by a multiple parallel channel for control and data signalization including a particular single control channel. A consumer electronics system may in particular comprise audio and/or video as user signalizations, although other types of services that a user may require are not excluded. A particular example of multi-contact connector is the standardized SCART connector that is used in combination with associated multi-wire cables for interconnecting audio/video apparatuses in the home, and for other applications. There is a proliferation of signal quality types available in modern audio/video systems, depending in particular on the program source. While many of these different signal types can be carried via multi-wire cables, either in parallel or as alternatives, consumers will generally need some automated system for selecting and routing of signals to thereby assure the realization of the best quality that is available for watching or recording a given program or using optimum other facilities.

One solution is to use a proprietary control system for making and breaking paths, as specified for pin 10 of the SCART connector system. The problem with such proprietary systems is that they offer only dedicated and brand-specific solutions that are often only valid for fixed combinations of products. They thereby exclude combining with products of other manufacturers, upgrading to a next product generation and often even combining with other contemporary products from the same manufacturer. Such proprietary solutions therefore need to be redeveloped from generation to generation.

One solution is to use a standard bus system such as D2B, which requires a dedicated interconnection, but provides many additional control functions for the user. On the other hand, for the problem of signal quality matching, a simpler control system can be implemented using a spare conductor in the conventional multi-wire cable. Such control system may be proprietary to one manufacturer, or may be standardized.

A problem arises in that when two or more control systems are available in a given apparatus, conflicts will arise as to which system actually has control. On the other hand, it is not desirable that a consumer who chooses at one point to use the simple solution is then prevented from gaining the benefits of a more functional control system at a later date, and forced to scrap the existing apparatus. In the long term, the consumer will benefit from compatibility of all his or her apparatuses, be they old or new.

SUMMARY TO THE INVENTION

Accordingly amongst other things, it is an object of the invention to in such systems provide a "migration path" towards a standard solution, of which a particularly useful example is a D2B system. Today's products getting more and more features, the proprietary solutions need upgrades, that may straightforwardly be implemented with the more powerful D2B system. A so-called system supported indication is proposed to find out whether the proprietary system implemented in a first product or initiator apparatus does match or does not match the proprietary system implemented in a second product or follower apparatus (which match is rather unlikely in the case of products from different manufacturers), or whether they both support the standard solution, such as for example the standard bus D2B. Stated otherwise, it is an object of the invention to allow an apparatus to use a proprietary control system integrated in a multi-wire cable, while maintaining the option to use alternative more advanced, and in particular, standardized control systems if and when these are supported by the other apparatuses of the system.

Now, according to one of its aspects, the invention is characterized in that the single control channel is configured as a **qualifier bus** channel that within each such apparatus is interfaced to a respective control element, said control element in at least a first initiator apparatus being arranged for transmitting a first message selectively specifying one of a plurality of proprietary signalization interfaces applicable to said initiator apparatus, and said control element in at least a second follower apparatus being arranged for acknowledging such first message upon matching therein of such proprietary signalization interface applicable to said follower apparatus, said system being arranged for thereupon coactivating such matched proprietary interfaces in both said initiator apparatus and in said follower apparatus.

In this way, the pairing of matched interfaces becomes extremely straightforward. The initiator apparatus may have only a single proprietary signalization interface, it may have more than one thereof, or it may have only one such interface that may however operate in an environment that allows more than only a single such interface.

Advantageously, in said first initiator apparatus said control element is arranged for as a prerequisite to said first message transmitting a second message specifying a standard control protocol defined on a further control channel external to said multiple parallel channel and said control element in at least a said

second follower apparatus being arranged for acknowledging such second message conditionally to matching therein of such standard control protocol applicable to said follower apparatus and defined on said further control channel, said system being arranged for thereupon coactivating such standard control protocol in both said initiator apparatus and in said follower apparatus. Accordingly, the hierarchy of a full-fledged realization according to the invention is organized as follows among the standard control protocol and the various proprietary interfaces. First, if both apparatuses concerned are found to support the D2B or other standard protocol, this will subsequently be used. Next, if one or both apparatuses do not support D2B, but both have the same proprietary solution implemented, the latter will be used. Only if no corresponding solution has been implemented, no control features can be communicated between the two apparatuses concerned. In situations concerning more than two apparatuses at a time, similar considerations apply between each respective pair of apparatuses.

Advantageously, said first and second messages are bitwise temporally hierarchized within a single message format. The fusing of first and second messages to a single format that is transmitted only once, speeds up the selection.

Advantageously, said system is arranged for in said initiator apparatus in said message presenting an escape signalization, of which a dominant value indicates that a subsequent bit train in said message will signal particular initiator apparatus supported and standardized signal quality parameters, whereas a recessive value indicates that a subsequent bit train in said message will signal particular initiator apparatus supported and proprietary defined signal quality parameters. In this way, an initiator apparatus that does not have the specific signal quality indication protocol according to the present invention gets its way by default, and on the other hand, the signalling of particular signal quality indications is particularly fast. Mirroring this feature said system is arranged for in said follower apparatus in said message presenting an escape acknowledging signalization, of which a dominant value signals forthcoming bitwise acknowledging of said standardized signal quality parameters as being supported by said follower apparatus, whereas a recessive value signals forthcoming bitwise acknowledging of said proprietary defined signal quality parameters as being supported by said follower apparatus. The same advantages are now attained with respect to a follower apparatus.

Advantageously, the system as claimed is arranged for in said message presenting a directional signalization with respect to a relative positioning of a source apparatus and a destination apparatus, respectively, with respect to a a data stream between said initiator and follower apparatuses.

The invention also relates to an initiator apparatus and to a follower apparatus for use in such system. Further advantageous aspects of the invention are recited in dependent claims.

BRIEF DESCRIPTION OF THE DRAWING

These and other aspects and advantages of the invention will be better appreciated with regard to the description of preferred embodiments hereinafter, and in particular with refernece to the appended Figures that show in particular:

Figure 1 shows a system of audio/video apparatuses interconnected for the communication of AV signals and control signals;

Figure 2 shows the signal allocations for two connectors and a multi-wire cable used in the system;

Figure 3 shows the frame format of control signals tranmsitted via a control wire in the multi-wire cable;

Figure 4 shows representative bit waveforms for the control signals.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 shows a system of domestic audio/video (AV) apparatuses 110, 112,114 etc. The first apparatus 110 is a display unit (television receiver or video monitor), while the remaining units are various AV apparatuses (VCR, satellite tuner, video disc player etc.) capable of acting as sources and/or destinations of AV signals.

Each apparatus has one or two special multi-wire sockets, physically similar to the well-known SCART or Peritel sockets (standard IEC 933-1). The apparatuses are connected in a chain-like manner via multi-wire cables 116, 118, 120 etc., starting from the display unit 110. AV signals can pass through these cables in both directions, and are designated "up-stream" or "downstream", according to whether their source apparatus or destination apparatus, respectively, is nearer in the chain to the display unit 110.

Referring also now to Figure 2, the special sockets are designated "I", if they are for connection to an apparatus which is downstream in the chain, and "II", if they are for connection to an apparatus which is up-stream in the chain. In accordance with its position always at the head of the chain, the display unit

apparatus 110 has only a type "I" socket.

Figure 2 shows the assignment of signals among numbered contacts 1-21 of the special SCART-like sockets: type "II" on the left and type "I" on the right. The corresponding conductors in the multi-wire calbe are also shown, in the central column of the Figure. In each apparatus, the corresponding contacts of sockets "I" and "II" are connected though to each other, either directly or via switches, so that the apparatus can send and receive AV signals to other apparatuses via the up-stream or down-stream signal paths. The user interface of each apparatus allows the user to distinguish between the up- and down-stream signal paths. For example, a VCR forming appartus 112 (Figure 1) may be given a RECORD UP command to record signals from a source apparatus (114, 116 etc.) further down the chain, and a RECORD DOWN command to record a signal coming from a signal source (TV tuner) in the display unit apparatus 110. Broadly speaking, the up-stream path will be used for playing functions to the user, and the down-stream path for recording.

While any multi-wire interconnection system may be used, the particular allocation of contacs 1-21 shown in Figure 2 provides a good degree of compatibility with the existing standard, allowing for the presence in the system of older apparatuses with conventional SCART connectors. Signal names, levels and impedances are accordingly made compatible with the existing conventions, unless stated otherwise.

Note that in each cable connection, there are two audio signal channels, A and B. Depending on the source of signals, channels A and B may be a stereo pair, or may carry monaural sound in two alternative languages. For video signals, similarly, the same program can be carried in various forms, referred to herein as signal qualities. There are up- and down-stream paths for composite video signals (CVBS),for signals with separate luminance and chrominance (Y and C), and there is an up-stream path only for primary colour signals RED, GREEN and BLUE (RGB).

Of these video signal qualities, RGB is preferred over Y/C, which is in turn preferred over CVBS. However, each source and destination apparatus may be limited in the signal qualities it can generate or accept at a given particular time, or at all times. Furthermore, the limited number of contacts and wires means that not all qualities can be carried in both directions at the same time. Note that signals CVBS up and C up share the same conductor as do signals CVBS down and C down, signals RED up and C up, and signals BLUE up and C down. An additional aspect of signal quality today is the aspect ratio of a video picture: whether it is of normal or wide screen format.

Some control mechanism is clearly required, at least to determine which signal qualities should be used at any point in a signal path, be it up-stream or down-stream, and this is provided via a control wire connected to each compatible apparatus via contact 10. Each apparatus 110, 112 and 114 has a standard control interface module CTRL1 within it to transmit and receive message frames via contact number 10. Contact 10 (and its return contact 21) are connected directly through each apparatus from socket 'I' to socket 'II'.

Figure 3 shows two types of message frame which can be sent by a module CTRL1 via the control wire (contact 10). A message frame will generally be sent when an apparatus changes state, typically as a result of a user command, or for example upon the triggering of a VCR timed recording. The apparatuses do not have individual addresses. Rather, for each frame, one apparatus acts as "initiator" of the message, while the others, referred to as "followers", are obliged to 'listen' to the frame. However, it will be seen that a follower is allowed to modify certain bits in each frame.

Figure 4 shows representative bit waveforms at the outputs of an initiator and a follower. The signal level actually present on the control wire (contact 10) is shown at the foot of Figure 4, and takes either a low or a high level, labelled L and H respectively. The output of each apparatus has a low impedance (dominant) state, labelled D in the figure, and a high impedance (recessive) state, labelled R. Since the outputs of all modules CTRL1 are connected together via the control wire, the level on the wire is a logical combination (wired-AND) of the outputs of all modules CTRL connected in the chain. Any output in the dominant state D will force the control wire low (L). The control wire will only be high (H) when all outputs are in the recessive (R) state.

Figure 4 illustrates three representative bit periods, numbered n, n+1 and n+2, during which the initiator outputs logical values '1', '1' and '0' in sequence. Each bit begins with a transition to the dominant state, at a time labelled BIT SYNC. All followers synchronize their bit timing to this event. At a predetermined time BIT SAMPLE following each BIT SYNC transition, the state D or R of the initiator output indicates, respectively, whether a '0' or '1' bit is being transmitted. On the other hand, the actual level L or H on the control wire at time BIT SAMPLE determines whether a logic '0' or logic '1' value is received for that bit by each module CTRL1. As can be seen in Figure 4, the bits n and n+2 will be received as logic '1' and '0' respectively, namely the values transmitted by the initiator. The bit n+1, however, is modified by the dominant output of the follower, so that a '0' will be detected instead of the '1' transmitted by the

initiator. The initiator also samples the actual level on contact 10, so that it too knows the modified bit value.

In Figure 3, two alternative frame formats are shown. Having established that no other module is transmitting on the control wire, the initiator generates a START signal for the frame, by making its output dominant for a period. The frame continues with a header comprising five bits labelled ESC, DIR, PAS, NAS and DES, then a further sixteen data bits. When ESC = 0, the sixteen bits are designated Quality bits QTY 1-16. When BSC = 1, the sixteen data bits are designated Control System Supported bits CSS 1-16, as shown in Figure 3.

In a frame with ESC = 0 the header and Quality bits provide a system for management of the signal path switching and video signal qualities, to provide the user with best quality signal paths from source to destination in up- and down-stream directions. This is achieved by the exchange of header data bits. Some of the data bits must only be set by the initiator, and will be referred to as flag bits. Others of the data bits may be modified by a follower, and are known as Arbitration bits. The detailed meaning of these bits will be described later.

Returning to Figure 1, this shows how other control modules of type CTRL2 and CTRL3 may be provided in a consumer apparatus. A module CTRL2 provides for control of and by the apparatus via a standard control bus, namely the D2B bus and related protocols. D2B distributes system control intelligence over all apparatuses, while providing for cooperation between apparatuses of different brands in a standardised manner. Compared with the CTRL1 system described so far, D2B requires dedicated cabling between apparatuses, but has the advantages of a full range of control features, more flexible signal routing, a higher data rate, full device-subdevice addressing and message security (parity checking). Due to crosstalk within the multi-wire cables, for example, the data rate of the control wire (SCART contact 10) must be kept very low. An example of D2B in application can be found in GB 2 223 114 A (PHN 12678), which describes the automatic establishment of signal paths between source and destination devices.

Like module type CTRL1, module type CTRL3 uses contact 10 and the control wire to provide a control function which is proprietary to one supplier. Various suppliers already produce or plan to produce apparatuses using contact 10 for their own purposes, and it is desirable that the proposed standard system should be able to function as an alternative to D2B or a proprietary system within the same apparatus. Otherwise the purchaser of a CTRL1 type apparatus would be 'locked out' of the market for enhanced facilities offered by D2B or proprietary solutions. The Control System Supported bits CSS 1-16 of the second message frame format (ESC = 1) provide a system of arbitration which selects the control module to be used from among those available in the relevant apparatuses.

In the following embodiment, it is assumed that each participating apparatus supports signal path and quality control via a module CTRL1 optionally via D2B (CTRL2) and optionally via one proprietary control protocol (CTRL3) only. Alternative embodiments can readily be conceived if necessary, for example to allow more than one proprietary control system, and other standard systems using the multi-wire cables or dedicated wiring, optical fibres etc.

The behaviour of the initiator and followers during a frame are defined below in a form of pseudo-code. The code will be largely self explanatory to the person skilled in the art, when keeping in mind the frame format as outlined in Figure 3 and the bit waveforms of Figure 4. It should be remembered in particular that a logic '1' in any bit position is recessive, so that a logic '0' output by another apparatus will predominate. As an example, the notaffon "Output QTY1 = 1 " indicates the value '1 ' for a bit output by the relevant apparatus during bit period QTY1, while "Sample QTY1 = 0" indicates that the actual bit value detected on the control wire (contact 10) during the same bit period is logic '0'. Explanatory comments are placed between curly brackets (braces) thus: {...}.

BEGIN [Header]

{Following the START bit, each bit of the frame is processed simultaneously by the initiator and the followers. The first Header Bit is the Escape Bit ESC.

As mentioned above, the Escape Bit depends on whether the initiating apparatus wishes to perform signal quality optimisation or to select the control system.}

BEGIN[ESC]

INITIATOR:

Output ESC=0

IF Sample ESC=0 THEN data bits are Signal Quality Bits

ELSE data bits are Control System Supported Bits

END

FOLLOWER:

Output ESC=1 {recessive}

IF Sample ESC=0 THEN data bits are Signal Quality Bits

ELSE data bits are Control System Supported Bits

END

{DIR is the Direction Bit determines whether this control frame concerns AV signals travelling up-stream or down-stream. This is of course relevant for switch settings and signal called capabilities within each apparatus.}

BEGIN [DIR]

INITIATOR:

IF signal direction is up-stream THEN Output DIR=1

ELSE Output DIR=0

END

IF Sample DIR=0 THEN direction is down-stream

ELSE direction is up-stream
END

FOLLOWER:
Output DIR=1 {recessive}
END
IF Sample DIR=0 THEN direction is down-stream
ELSE direction is up-stream
END

{PAS depends on whether any apparatus is Presently an Active Source of AV signals for an established signal path in the specified direction.}

BEGIN [PAS]
INITIATOR:
IF initiator is present active source THEN Output PAS=0
ELSE Output PAS=1 {recessive}
END
IF Sample PAS=0 THEN source is present
ELSE there is no active source
END
FOLLOWER:
IF follower is present active source THEN Output PAS=0
ELSE Output PAS=1 {recessive}
END
IF Sample PAS=0 THEN source is present
ELSE there is no active source
END

{NAS: An apparatus is a new active source when it is activated by a user to supply AV signals and no signal path has been established yet.}

BEGIN [NAS]
INITIATOR:

```
            IF initiator is new active source THEN Output NAS=0
            ELSE Output NAS=1 {recessive}
            END
            IF Sample NAS=0 THEN source is new
            ELSE there is no new source
            END
        FOLLOWER:
            IF follower is new active source THEN Output NAS=0
            ELSE Output NAS=1 {recessive}
            END
            IF Sample NAS=0 THEN source is new
            ELSE there is no new source
            END

{DES: An apparatus responds with the DES bit when it is active as a destination for AV
signals in the specified direction.}

BEGIN [DES]
        INITIATOR:
            IF initiator is active as destination THEN Output DES=0
            ELSE Output DES=1 {recessive}
            END
            IF Sample DES=0 THEN there is an active destination
            ELSE there is no active destination
            END
        FOLLOWER:
            IF follower is active as destination THEN Output DES=0
            ELSE Output DES=1 {recessive}
            END
            IF Sample DES=0 THEN there is an active destination
            ELSE there is no active destination
            END
END [Header]
```

{Turning to the data bits, for a frame with Sample ESC=0, the data bits are signal quality bits QTY 1-16. Initiator and Follower need not be distinguished, provided that the reader notes the distinction between 'flag' type bits and 'arbitration' type bits defined above.}

BEGIN [Signal Quality Bits]

{QTY 1-6 are Arbitration type bits for determining the best video quality capabilities available in the signal path:}

Output QTY1,2,3=0 {these are available for future use}

IF Y/C quality supported THEN Output QTY4=1 {recessive}

ELSE Output QTY4=0 {dominant; Y/C not acceptable}

IF RGB quality supported THEN Output QTY5=1 {recessive}

ELSE Output QTY5=0 {RGB not acceptable}

IF Wide Screen supported THEN Output QTY6=1 {recessive}

ELSE Output QTY6=0 {Wide Screen not acceptable}

{QTY 7-16 are Flag type bits set by a source apparatus. A logic '1' in this position indicates that the signal qualities or other attribute applies to the signal actually being supplied. The meaning of each attribute will be apparent to the person skilled in the art.}

QTY7 {Full field wide screen video is supplied}

QTY8 {Letterbox format video is supplied}

QTY9 {Video shifted upwards is supplied}

QTY10 {Demodulated helper is supplied (PAL-plus system)}

QTY11 {Digital Audio is supplied}

QTY12 {Audio only is supplied}

QTY13 {Audio supplied is bilingual}

QTY14-16 {available for future use}

END [Signal Quality Bits]

{In a frame where Sample ESC=1 the data bits are Control System Supported bits CSS1...CSS16.}

BEGIN [Control System Supported]

IF D2B standard is supported (module CTRL2 present)

THEN Output CSS1=1

ELSE Output CSS1=0 {dominant}

{CSS2...CSS15 are 'Flag' type bits, set by the initiator of the frame, and specify that the relevant control system is supported as follows:}

IF Proprietary system is supported (module CTRL3 present)

THEN Output CSS2...CSS15= Control System Number

{The bits CSS2...CSS15 carry a binary number identifying a proprietary control system using contact 10.}

ELSE Output CSS2...CSS15 = zero

{CSS16 is an Arbitration type bit, and will be forced to '0' if any apparatus in the signal path does not support the proprietary system.}

IF specified proprietary system is supported

THEN Output CSS16=1

{proprietary system acknowledged}

ELSE Output CSS16=0 {dominant}

END [Control System Supported]

From the above, it will be apparent to the skilled person how the best signal quality which is supported throughout the signal path can be identified and used to implement the user's wishes using the best possible quality. For example, if any apparatus in the chain does not support RGB quality signals, the bit QTY5 will be forced low, telling the source apparatus that Y/C or CVBS must be used.

Similarly, a priority is established between the various control systems and protocols that may be available within the system. If the D2B standard is supported by all apparatuses in the signal path, then bit CSS1 will be '1'. Then all apparatuses will respond to control via their D2B interface (modules CTRL2) only. This is desirable in view of the greater range of control features provided, inter-brand compatibility, better error handling and so forth.

On the other hand, if not all apparatuses can be controlled via D2B, but they can communicate via the control wire (contact 10), then it is desirable that they do so. If all apparatuses are provided with control modules CTRL3 which support the same proprietary control system, then this may be preferred over the use of the CTRL1 system.

Many variations will be readily envisaged by the skilled reader, and the scope of the present invention is in no way limited to the specifics of the above embodiment.

Claims

1. A consumer electronics system comprising a plurality of apparatuses that are interconnected by a multiple parallel channel for control and data signalization including a particular single control channel, characterized in that the single control channel is configured as a **qualifier bus** channel that within each such apparatus is interfaced to a respective control element, said control element in at least a first initiator apparatus being arranged for transmitting a first message selectively specifying one of a plurality of proprietary signalization interfaces applicable to said initiator apparatus, and said control element in at least a second follower apparatus being arranged for acknowledging such first message upon matching therein of such proprietary signalization interface applicable to said follower apparatus, said system being arranged for thereupon coactivating such matched proprietary interfaces in both said initiator apparatus and in said follower apparatus.

2. A system as claimed in claim 1, wherein in said first initiator apparatus said control element is arranged for as a prerequisite to said first message transmitting a second message specifying a standard control protocol defined on a further control channel external to said multiple parallel channel and said control element in at least a said second follower apparatus being arranged for acknowledging such second message conditionally to matching therein of such standard control protocol applicable to said follower apparatus and defined on said further control channel, said system being arranged for thereupon coactivating such standard control protocol in both said initiator apparatus and in said follower apparatus.

3. A system as claimed in claim 2, wherein said first and second messages are bitwise temporally hierarchized within a single message format.

4. A system as claimed in claim 2 or 3, wherein said further control channel is a D2B channel.

5. A system as claimed in any of claims 1 to 4, wherein at least said initiator apparatus comprises at least two different such interfaces, and said system is arranged for executing a search for finding a matching pair of such interfaces in said initiator apparatus and said follower apparatus.

6. A system as claimed in any of claims 1 to 5, and being arranged for in said initiator apparatus in said message presenting an escape signalization, of which a dominant value indicates that a subsequent bit train in said message will signal particular initiator apparatus supported and standardized signal quality parameters, whereas a recessive value indicates that a subsequent bit train in said message will signal particular initiator apparatus supported and proprietary defined signal quality parameters.

7. A system as claimed in claim 6, and being arranged for in said follower apparatus in said message presenting an escape acknowledging signalization, of which a dominant value signals forthcoming bitwise acknowledging of said standardized signal quality parameters as being supported by said follower apparatus, whereas a recessive value signals forthcoming bitwise acknowledging of said proprietary defined signal quality parameters as being supported by said follower apparatus.

8. A system as claimed in any of claims 1 to 7, and being arranged for in said message presenting by said initiator apparatus a directional signalization with respect to a relative positioning of said initiator and follower apparatus, respectively.

9. A system as claimed in any of claims 1 to 8, and being arranged for in said message presenting an initialization signalization with respect to a said initiator apparatus, and acknowledging said initialization signalization with respect to said follower apparatus, respectively.

10. An initiator apparatus for use in a system as claimed in any of claims 1 to 9.

11. A follower apparatus for use in a system as claimed in any of claims 1 to 9.

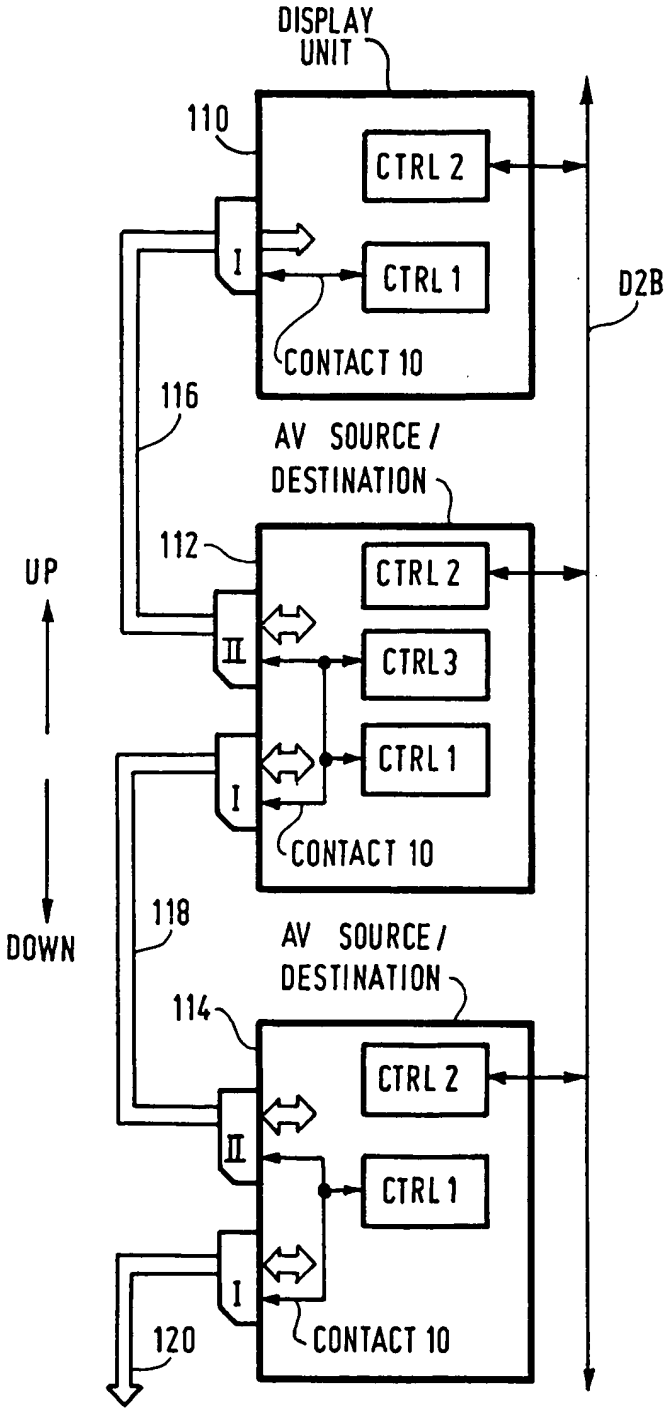
DISPLAY UNIT
110
CTRL 2
I
CTRL 1
D2B
CONTACT 10
116
AV SOURCE / DESTINATION
112
CTRL 2
II
CTRL 3
CTRL 1
I
CONTACT 10
UP
DOWN
118
AV SOURCE / DESTINATION
114
CTRL 2
II
CTRL 1
I
CONTACT 10
120

FIG.1

UP-STREAM (towards Display Unit)

DOWN-STREAM (away from Display Unit)

SOCKET II			MULTI-WIRE CABLE		SOCKET I	
AUDIO A up	(out)	o 3	o——o	3	o AUDIO A down	(out)
AUDIO B up	(out)	o 1	o——o	1	o AUDIO B down	(out)
AUDIO A down	(in)	o 6	o——o	6	o AUDIO A up	(in)
AUDIO B down	(in)	o 2	o——o	2	o AUDIO B up	(in)
AUDIO common return		o 4	o——o	4	o AUDIO common return	
CVBS up or Y up	(out) (out)	o 19	o——o	19	o CVBS down or Y down	(out) (out)
Return contact 19		o 17	o——o	17	o Return contact 19	
CVBS down or Y down	(in) (in)	o 20	o——o	20	o CVBS up or Y up	(in) (in)
Return contact 20		o 5	o——o	5	o Return contact 20	
RED up or C up	(out) (out)	o 15	o——o	15	o REd up or C up	(in) (in)
Return contact 15		o 13	o——o	13	o Return contact 15	
GREEN up	(out)	o 11	o——o	11	o GREEN up	(in)
Return contact 11		o 9	o——o	9	o Return contact 11	
BLUE up or C down	(out) (in)	o 7	o——o	7	o BLUE up or C down	(in) (out)
Return contact 7		o 5	o——o	5	o Return contact 7	
STATUS and ASPECT RATIO up	(out)	o 20	o——o	20	o STATUS and ASPECT RATIO up	(in)
BLANKING up	(out)	o 16	o——o	16	o BLANKING up	(in)
Return contact 16,12		o 14	o——o	14	o Return contact 16,12	
FUTURE USE (reserved)		o 12	o——o	12	o FUTURE USE (reserved)	
CONTROL (bi-directional)		o 10	o——o	10	o CONTROL (bi-directional)	
COMMON RETURN of contacts 8 & 10		o 21	o——o	21	o COMMON RETURN of contacts 8 & 10	

FIG. 2

START	ESC=0	DIR	PAS	NAS	DES	QTY 1-16

FIG.3a

START	ESC 1	DIR	PAS	NAS	DES	CSS 1-16

FIG.3b

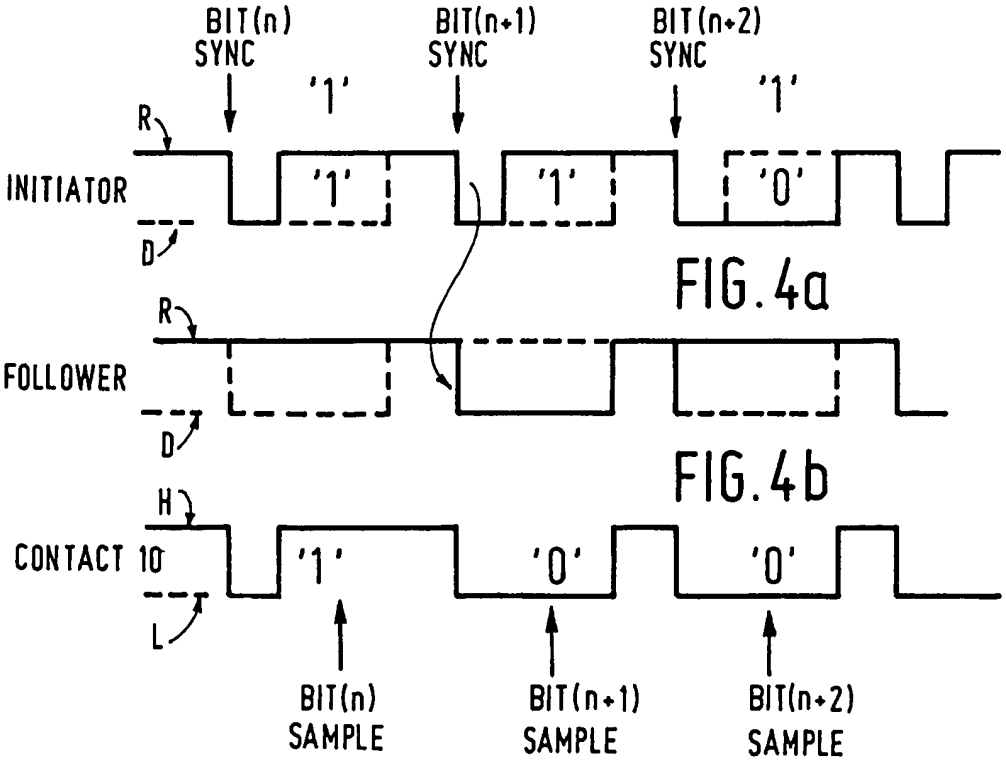

FIG.4c